Abstracts of Technical Articles From Bell System Sources

Relation of Nitrogen to Blue Heat Phenomena in Iron and Dispersion-Hardening in the System Iron-Nitrogen.[1] R. S. DEAN, R. O. DAY and J. L. GREGG. It has been generally observed that iron, as an outstanding exception among metals, increases its hardness and strength by low-temperature annealing after cold work, and also by increase of testing temperature to the range of 150° C. to 300° C. This investigation was made with the object of ascertaining if similar phenomena were observed in high purity iron and, if not, to the presence of which impurities these phenomena could be traced. After describing the tests made and giving the results, the authors come to the conclusion that commercial irons owe their property of hardening by reheating after cold work, as well as their increase in tensile strength in the range 100° C. to 300° C., to the solution of small amounts of iron-nitride present.

Heat Treatment and Mechanical Properties of Some Copper-Zinc and Copper-Tin Alloys Containing Nickel and Silicon.[2] W. C. ELLIS and EARLE E. SCHUMACHER. The addition of nickel and silicon to the copper-zinc and copper-tin systems results in alloys which can be hardened by heat treatment. The heat treatment, in general, consists of a quench from 800° C. followed by hardening at 400° C. to 500° C. The dispersion-hardening effect of nickel and silicon in these alloys opens a considerable field in the manufacture of high strength brasses. The mechanical properties in the rolled condition of the hardened brass containing 30 per cent of zinc and 3 per cent of nickel plus silicon are in general similar to those of high brass sheet in the spring temper. The endurance limit in reversed flexure for this alloy in the hardened condition is, however, approximately 20 per cent higher than that of high brass sheet in the same temper.

A Metallographic Study of Tungsten Carbide Alloys.[3] J. L. GREGG and C. W. KÜTTNER. This paper gives the results of an investigation of the structure of five of the tungsten-carbon alloys by means of microscopic and X-ray methods, the samples studied being small tools or wire-drawing dies. After a general discussion of the constituents of tungsten-carbon alloys, the preparation of the samples is described, and the structures found are shown in twenty-one figures accompanying the text.

[1] *Mining and Metallurgy*, Vol. 10, March, 1929, p. 163 (abstract).
[2] *Mining and Metallurgy*, Vol. 10, March, 1929, p. 162 (abstract).
[3] *Mining and Metallurgy*, Vol. 10, February, 1929, p. 94 (abstract).

Motion Pictures in Relief.[4] HERBERT E. IVES. In this article Dr. Ives describes the method by which stereoscopic motion picture projection can, theoretically at least, be attained. The method is relatively complicated and has severe practical limitations. It appears to be theoretically sound and capable of realization, at least on an experimental scale.

The Absorption of Oxygen by Rubber.[5] G. T. KOHMAN. The work reported in this paper was planned for the purpose of determining the part played by oxygen absorption in the natural aging of rubber. To do this, the effects of a number of factors known to influence natural aging on rates of oxygen absorption were studied. A piece of apparatus, developed for determining these rates, which involves special means for keeping the oxygen pressure surrounding the sample constant is described. The results obtained lead to the conclusion that oxygen absorption is the predominating factor in the natural aging of rubber and that rates of oxygen absorption are of value in predicting the natural life of rubber.

An Electrical Test for Tin Coating on Copper Wire.[6] H. M. LARSEN and C. M. UNDERWOOD. The method described is essentially a deplating process. The wire samples are placed in an acid solution and a current of suitable value applied to effect the deplating. The weight of tin on the wire surface and that alloyed with the copper are determined separately, the measuring means being two graduated tubes containing electrodes (sometimes called voltameters). The gas evolved in these voltameters is proportional to the current and hence to the tin being removed. As soon as the copper surface is exposed, an auxiliary electrode in the deplating bath actuates a relay which brings into operation the second voltameter, permitting determination of the tin alloyed with the copper.

Very simple formulæ permit determining the amount of tin from the volume of gas accumulated in the two voltameters. The method is said to save time and permit the use of relatively unskilled operators as compared with the usual chemical tests applied to tin coatings.

Further Observations on the Microstructure of Martensite.[7] FRANCIS F. LUCAS. This paper is a further contribution by Dr. Lucas on the microstructure of martensite. It describes a number of quenching and

[4] *Journal of the Optical Society of America and Review of Scientific Instruments*, Vol. 18, February, 1929, pp. 118–122.
[5] *Journal of Physical Chemistry*, Vol. 33, February, 1929, pp. 226–243.
[6] *Wire & Wire Products*, Vol. 4, April, 1929, pp. 118–119, 140.
[7] *Transactions of the American Society for Steel Treating*, Vol. 15, February, 1929, pp. 339–364.

tempering experiments in which commercial high quality tool steels were used. Representative structures found in the quenched and various tempered conditions are illustrated and discussed.

Technique of the Talking Movie.[8] DONALD MACKENZIE. In this article the talking movies are described in some detail as to mechanical features, production and exhibition. The author tells some interesting things about producing these pictures and the human reactions that must be considered in preparing a picture with sound record so that it will seem natural and the changes that producers will have to make to satisfy the public.

Some Long Distance Transmission Problems.[9] H. MOURADIAN. This paper discusses the transmission properties of high voltage power transmission lines with incidental reference to telephone transmission. The method of improving the performance of power lines by means of synchronous condensers at the ends and at intermediate points is discussed and compared with a proposed method in which neutralizing networks are neutralized at intervals. Each network consists of a pi whose series and shunt elements neutralize the corresponding elements of the line at the frequency of transmission. It is stated that the synchronous condensers increase the power transfer limits of the line but decrease the transmission efficiency, while the neutralizing networks increase both the power transfer limits and the efficiency. Illustrative numerical examples are given for a 220,000-volt line, 500 miles long. Some possibilities of a transcontinental power transmission line are discussed.

Electrical Conduction in Textiles. Part II—Alternating Current Conduction.[10] E. J. MURPHY. This paper shows the variation of the equivalent parallel capacity and conductance of cotton and silk with relative humidity and frequency (for a small range). It also shows the effect of changes in the amount of electrolytic material in the textile. The main results are: At high humidities the capacity is greatly reduced by a reduction in the amount of electrolytic material in the textile. The a.c. and d.c. conductivities of cotton approach each other as the humidity is increased and become equal at humidities greater than 80–85 per cent (that is, dielectric loss is entirely due to direct current conductivity in this range). At humidities lower than this a large part of the dielectric loss is not due to d.c. conduction, but this

[8] *Journal of the Western Society of Engineers*, Vol. 34, February, 1929, pp. 95–102.
[9] *Journal of the Franklin Institute*, Vol. 207, February, 1929, pp. 165–192.
[10] *Journal of Physical Chemistry*, Vol. 33, February, 1929, pp. 200–215.

part of the dielectric loss is also strongly affected by the amount of electrolytic material in the textile. These characteristics can be explained if the textile is regarded as an electrolytic cell in which the absorbed water and dissolved salts form the electrolyte and the solid constituents of the textile act as a container which determines the volume, geometric form and specific conductance of the electrolyte. The capacity at high humidities is regarded as due chiefly to the electrolytic polarization capacity of this electrolyte.

Electrical Conduction in Textiles. Part III—Anomalous Properties.[11] E. J. MURPHY. This paper deals with the increase of conductivity with increasing applied voltage (the Evershed effect), and with the residual electromotive forces and changes in resistance produced by the passage of current through the textile. The results point to the conclusion that the Evershed effect is due to two factors, a back-e.m.f. due to electrolytic polarization, and an increase, caused by the increase in voltage, in the amount to which the ions adsorbed by the interface between the aqueous solutions and the solid material of the textile contribute to the total conductivity. The characteristics of the residual e.m.f. change with humidity; at high humidities the e.m.f. is apparently caused by chemical changes in the aqueous solutions due to their electrolysis. It was found that the passage of a current through a textile causes its resistance to become non-uniformly distributed, the distribution depending on the nature of the electrode material; this is interpreted as due to changes in the chemical composition of the solutions in different parts of the textile. The anomalous properties can be explained in terms of the electrolytic cell mechanism suggested in the preceding paper by attributing to the solid in which the aqueous conducting paths are contained the properties of adsorbing ions and of hindering the equalization of concentration differences in the solutions by diffusion. Thus, all of the properties of conduction in textiles observed in this investigation can be explained in terms of a single general mechanism which appears to be a probable consequence of the colloidal structure of the materials.

Study of Weller Brittleness Test for Paper.[12] R. L. PEEK, JR. and J. M. FINCH. On the assumption that paper possesses certain basic properties, an expression is theoretically obtained relating the results of the Weller brittleness test to these basic properties, the dimensions of the sample, and the conditions of testing. Experimental data are presented which show that the effect of the sample dimensions and the

[11] *Journal of Physical Chemistry*, Vol. 33, April, 1929, pp. 509–532.
[12] *Paper Trade Journal*, Vol. 88, February 7, 1929, pp. 56–62.

conditions of testing are substantially as indicated by the theoretical expression. The theory is then employed to interpret the results of the test and to indicate the best form in which these may be expressed. The general question of testing for flexibility and brittleness is considered in the light of this study.

Diffusion of Water through Rubber.[13] EARLE E. SCHUMACHER and LAWRENCE FERGUSON. This article gives data on the diffusion of water through thirteen rubbers of different compositions. The mathematical derivation of a simple formula for calculating the rate of diffusion has been given. The diffusion measurements have shown: (*a*) that the rate of diffusion of water through a rubber membrane is inversely proportional to the square of the thickness; (*b*) that the rate of diffusion decreases greatly with increase in hardness; (*c*) that the effect of saturating the rubber with water is to increase the rate of diffusion through it, due probably not only to an increase in the water vapor pressure within the rubber, but also to a decrease in hardness; (*d*) that there is no intimate relationship between rate of diffusion and minor variations in the composition of the rubber.

Effect of Arsenic on Dispersion-Hardenable Lead-Antimony Alloys.[14] K. S. SELJESATER. Arsenic has no solid solubility in lead and is known to form a continuous series of solid solutions with antimony. Therefore, immediately after annealing and quenching the antimony is in solid solution in the lead, and there is a certain amount of eutectic between the lead-antimony solid solution and arsenic. After quenching, the lead-antimony solid solution is supersaturated (the same as if arsenic were not present) and minute crystals of antimony separate. Since arsenic is soluble in antimony, some of the arsenic present will be concentrated in the surface layer of the minute antimony particles, which will then possess surface conditions different from those of pure antimony particles. The condition of the alloy at this stage is analogous to a suspension in a liquid which has been partly stabilized by a third constituent. Agglomeration and precipitation will occur, but at a much slower rate than if the third constituent were not present. Arsenic, therefore, is to be considered as a retardant for the agglomeration of minute antimony particles in the lead matrix. The length of the stabilization time decreases at elevated temperatures. The offered explanation is in agreement with the fact that the increase in hardness is practically independent of the percentage of arsenic within limits investigated. The addition of a third constituent insoluble in the

[13] *Industrial and Engineering Chemistry*, Vol. 21, February 1, 1929, pp. 158–162.
[14] *Mining and Metallurgy*, Vol. 10, February, 1929, p. 94 (abstract).

solvent and forming a continuous series of solid solutions with the solute, might be of advantage to other kinds of age-hardenable binary alloys.

A Precision Regulator for Alternating Voltage.[15] H. M. STOLLER and J. R. POWER. In this paper a recently developed precision voltage regulator for use with alternating current is described. It will maintain its output voltage constant to within 0.03 per cent over an input voltage range of 10 per cent and a load range of from zero to full load.

This regulation is accomplished by means of a small transformer inserted in one of the lines which boosts or bucks the impressed voltage by the required amount. The transformer is controlled by a vacuum tube circuit acting through an inductance bridge.

[15] *Journal of the A. I. E. E.*, February, 1929, Vol. 48, pp. 110–113.